

Memo

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From: Stephen G. Pouliot, PE

To: Joe Kammerer
Mary Deloretto

UDOT Project Manager
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Date: November 29, 2004

Copies To: Michael Falini

File No.: X3-310-010

Subject: 700 West

The Draper City has expressed concern over the planned phasing of the preferred alternative. There are three issues raised that need to be addressed.

1. *"The Alternative 4 description fails to adequately explain the impact to Draper City streets if the (11400 South) interchange were built with the current funding and the river bridge delayed until additional funding could be acquired."*
2. *"... the Level of Service (LOS) along 11400 South in the area of 700 West and Lone Peak Parkway would be similar in 2012 with or without the river crossing. The LOS at the 700 West intersection would be LOS A either with or without the river crossing."*
3. *"Clearly the (traffic) study did not look at impacts beyond the intersections of the 11400 South corridor."*

In response to the above issues, model information was reviewed that was used for the interim phasing analysis study.

1. The planning level volumes generated by the 2012 models for the 700 West corridor show that it will be below capacity. Table 1 below summarizes the maximum number of vehicles per day (vpd) assigned to 700 West and Lone Peak Parkway for each model.

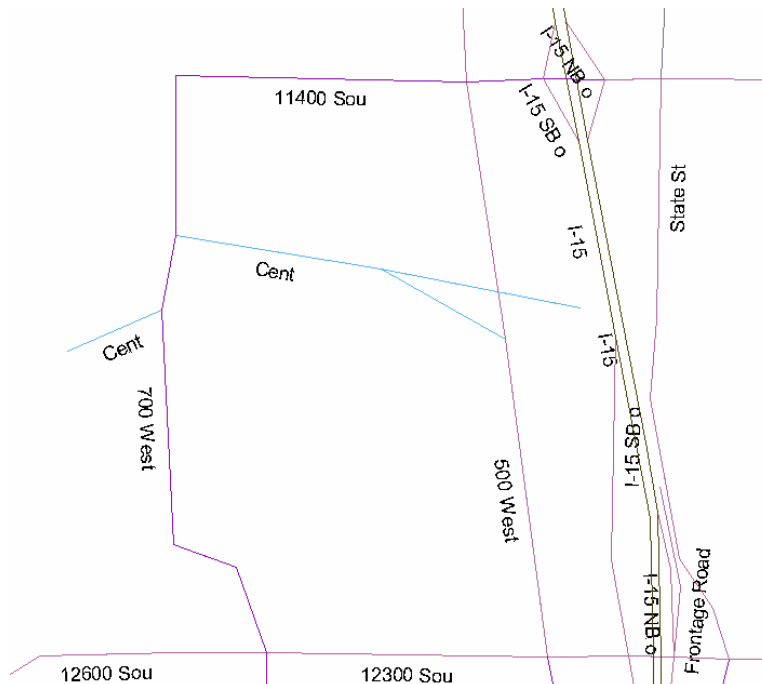
The designated all-day traffic capacity for the functional classification described by the Draper City Functional Classification Planning and Design Guidelines is 8,000 to 12,000 for minor collectors (700 West) and 15,000 to 18,000 for major collectors (Lone Peak Parkway). Table 1 suggests that the 2012 traffic volumes will exceed the all-day capacity of Lone Peak Parkway for all but model P. Some of this excess traffic may spill over to 700 West. However, the land use and origin/destination location in the models for Lone Peak Parkway suggest that there are no alternatives to using Lone Peak Parkway and therefore the spill over to 700 West will be minimal.

**Table 1. Maximum Assigned 2012 Model Average Daily Traffic Volumes
on 700 West and Lone Peak Parkway south of 11400 South**

Model Description	2012 ADT 700 West	2012 ADT Lone Peak Parkway
A. NO River Crossing and NO Interchange at I-15	4,100	21,700
B. With River Crossing and NO Interchange at I-15	7,900	19,900
D. NO River Crossing and an Interchange at I-15	4,300	20,700
P. With River Crossing and Interchange at I-15	7,700	16,200

- The 700 West intersection without the river crossing is unsignalized and operates at LOS A. The addition of a river crossing increases the volume on 11400 South and 700 West such that a signal would be needed to provide an acceptable LOS. LOS for an unsignalized intersection and a signalized intersection are based on different parameters and cannot be compared one to the other.
- The 2012 transportation models developed by WFRC for the interim phasing analysis include 700 West as a two-lane minor collector. The local streets and driveways along 700 West between 11400 South and 12300 South (around two dozen existing) are modeled as only two loading points – one on the east and one on the west (labeled CENT in Figure 1). This makes it difficult to identify LOS impacts at each location.

Figure 1. 2012 Model with 11400 South Interchange and No River Crossing



The AM peak hour is when most vehicles will be entering onto 700 West from a side street. The AM peak hour volume on 700 West is about 11 percent of the ADT, or around 870 vph (worst case model B in Table 1). The left turn volume from the side street onto 700 West is the critical movement because it must yield to all traffic on 700 West (see Figure 2). The volume necessary for this left turn movement to create a failing LOS was evaluated.

Figure 2. Critical Side Street Movement

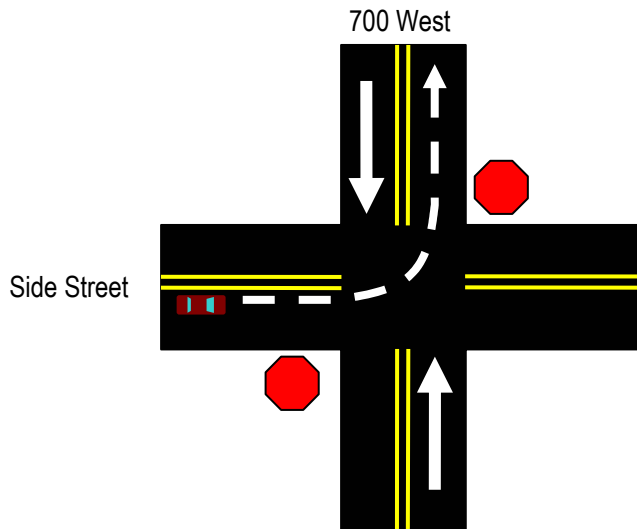


Table 2 below summarizes what the AM peak hour left turn volume would need to be in the range of LOS A-F at an unsignalized intersection¹. From the table, the lower-limit capacity of the intersection (given the assumptions) is 85 left turns (120 upper-limit).

Table 2. AM Peak Hour Side Street Left Turn Volume and Corresponding LOS for Unsignalized Intersection with 700 West

LOS	Left Turn Volume	Delay (sec)	Queue Length (veh)
A	*	*	*
B	*	*	*
C	< 20	25 sec	1
D	25 - 80	35 sec	2
E	85 - 120	50 sec	4
F	> 125	> 50 sec	> 4

¹ Assumes a four-way intersection, a 75/25 directional split on 700 West, no right turn volume from side street or 700 West (worst case), and 5 percent left turns from 700 West into side streets.

This equates to $\left(\frac{85}{0.75}\right) = 115$ vehicles per hour on the side street; $\left(\frac{115}{0.08}\right) = 1440$ vehicles per day on the side street.

1440 vehicles per day in a housing development is the equivalent of about 144 single family houses, each generating an average of about 10 trips per day. This is slightly smaller than the size of the single family development (170 houses) at the northwest corner of 700 West and 12300 South (which, incidentally, has two accesses onto 700 West and one onto 12300 South).

Draper City ordinance 17-5-030 (f) and (g) that places a limit on the number houses served by a cul-de-sac or dead-end street to no more than twenty lots or units. Using this limit, the maximum number of trips generated by the development would be 200 vehicles per day with 16 occurring during the AM peak hour. The outbound side street traffic in the morning would experience LOS C.

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Date: December 17, 2004

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File No.: X3-310-010

Subject: 445 West and 11400 South

Concern has been raised over whether or not the access to 445 West from 11400 South will be affected by the Preferred Alternative. An analysis of the traffic operations at 445 West and 11400 South has been completed and the results follow.

Trip Generation for the 445 West Housing

There are 12 houses that have access to 11400 South from 445 West. An average trip rate of 10 trips per day per household equals 120 vehicles per day (vpd) on 445 West. Dividing this into AM (8%) and PM (10%) peak hour volumes:

AM peak hour volume: $120 \text{ vpd} \times 0.08 = 10 \text{ vehicles per hour}$; 75% exit, 25% enter; 7 vph exit, 3 vph enter

PM peak hour volume: $120 \text{ vpd} \times 0.10 = 12 \text{ vehicles per hour}$; 35% exit, 65% enter; 4 vph exit, 8 vph enter

For the operations analysis it was assumed that half of the trips were heavy vehicles to approximate the trailer traffic known to exist on 445 West. Figures 1 and 2 show the peak hour volumes used for the analysis, including the projected 2030 peak hour volumes for 11400 South.

Figure 1. 2030 AM Peak Hour Volumes

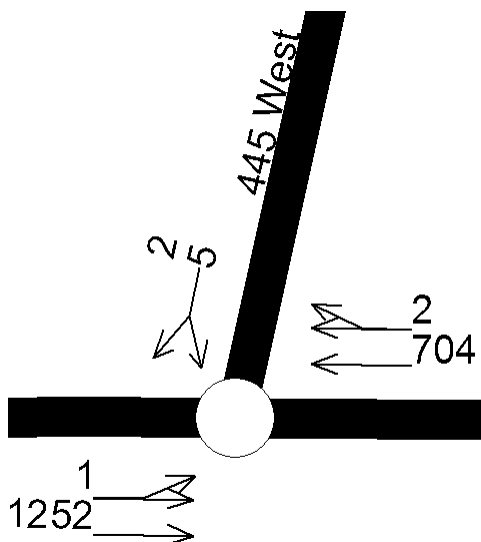
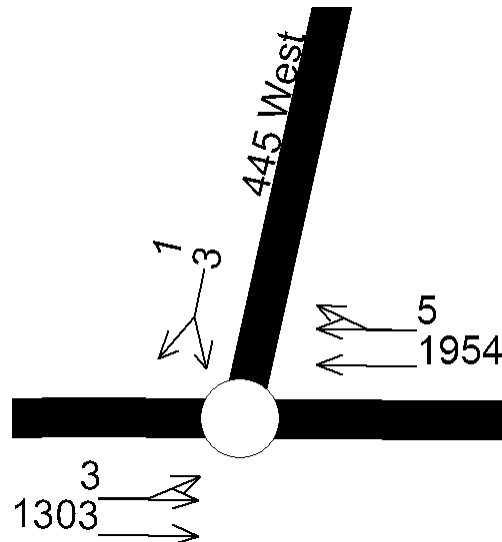


Figure 2. 2030 PM Peak Hour Volumes



Traffic Operations Analysis**AM Traffic**

Highway Capacity Manual (HCM) methodology was not used for this analysis. The HCM methodology for unsignalized intersections doesn't adequately account for - and underestimates - the effect of the adjacent signalized intersections (on 11400 South on either side of the 445 West intersection).

To determine the effect of the signalized intersections on the LOS, simulations (from SimTraffic) were run. Eight simulations were run of the 11400 South network to get an average delay for the 445 West approach. From the simulations, the adjacent signalized intersections allow some gaps in 11400 South traffic at 445 West, and show 18 seconds of delay per vehicle for the critical left turn movement at 445 West. This is equivalent to a LOS C.

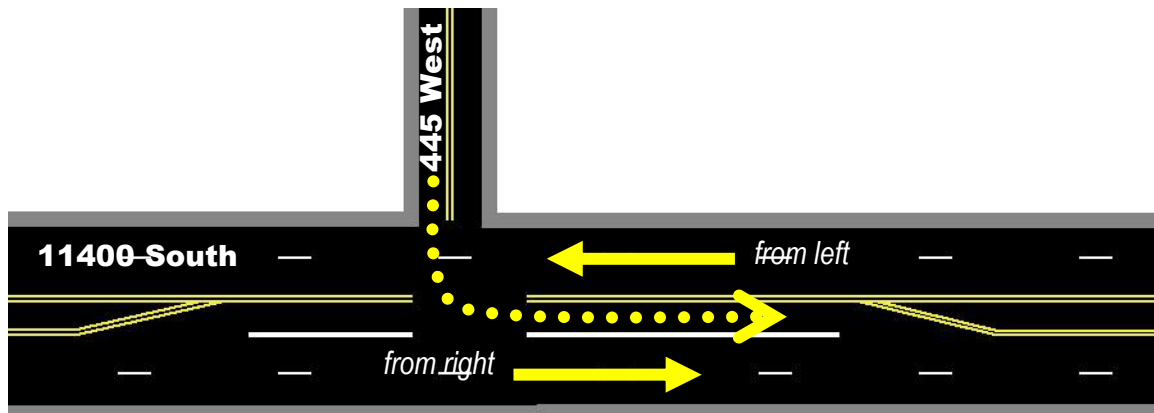
PM Traffic

The PM analysis shows less exiting traffic from 445 West, but more traffic on 11400 South. Again, eight simulations were run. The simulations show that the outbound traffic, specifically the left turn, is a LOS E with 40 seconds of delay per vehicle. The 40 seconds of delay seems realistic given that the vehicles on 445 West waiting to turn left will need to wait for the 150 second and 75 second signal cycles at Jordan Gateway/Lone Peak Parkway and at 700 West respectively, to provide gaps in traffic. It is noted again that the LOS E is experienced by relatively few drivers turning left during the PM peak hour.

Other Options

Another option for the intersection is to provide a safe harbor lane for the left turning traffic (see Figure 3). The harbor lane provides a left turning movement that separates the through traffic conflicts on 11400 South into two stages. The left turn yields to traffic approaching from the left, turns into the harbor lane, then merges with traffic approaching from the right. A safe merging movement can be made when the turning vehicle reaches a minimum of 85 percent of the mainline speed. For a mainline design speed of 35 mph the harbor lane should be between 250-300 feet long. This assumes that the entry speed of the turning vehicle into the harbor lane is 10-15 mph.

Figure 2. Harbor Lane



Using the simulation analysis, the operations of the left turn from 445 West improve to 8 seconds of delay, or LOS A for the AM peak hour and 22 seconds of delay, or LOS C for the PM peak hour. The eastbound merging movement can be expected to operate at LOS A and LOS B for AM and PM peak hours, respectively.

A new analysis will be necessary if the property on the south side of 11400 South develops. At that time, the determination would need to be if a signal or other measures are needed to provide an acceptable level of service. The harbor lane would have to be removed if there is development on the south side.

Memo

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Subject: Modeling Analysis - Bangerter Highway conversion from four lanes to six lanes

UDOT is proposing to restripe the Bangerter Highway from a four-lane section (two lanes in each direction) to a six-lane section (three lanes in each direction) between 10600 South and Interstate 15. This effort does not involve any highway widening, only restriping. The proposed restriping is not currently in the long range plan and was not modeled by Wasatch Front Regional Council (WFRC) during the 11400 South EIS project process. This memo documents the traffic impacts in the study area as a result of this change. A step by step description of the analysis is given below:

- Raw model data (without any data post-processing) provided by WFRC was used.
- Four models for the year 2030 (two models for the No Build Alternative and two models for Alternative 4) were compared in this analysis. The models used are listed below:
 - i) No Build Alternative with a four-lane section for the Bangerter Highway.*
 - ii) No Build Alternative with a six-lane section for the Bangerter Highway.*
 - iii) Alternative 4 with a four-lane section for Bangerter Highway.*
 - iv) Alternative 4 with a six-lane section for Bangerter Highway.*
- Traffic volumes for the entire day, AM peak hour, and the PM peak hour were analyzed at 14 pre-selected locations within the study area, which were likely to be impacted by the recommended change on the Bangerter Highway.
- The percentage change in volumes at these locations for the entire day, the AM peak hour and the PM peak hour was computed for the two scenarios (No Build Alternative and Alternative 4)
- It was noted that volume changes of over 10 percent occur on the Bangerter Highway for both the No Build Alternative and Alternative 4.
- It was also noted for the No Build Alternative that a volume change of 11.3 percent on 11400 South at Jordan Gateway/Lone Peak Parkway, for the AM peak hour, is relatively small given the low volume on 11400 South.

Summary:

The conversion of Bangerter Highway from four lanes to six lanes has little effect on the 11400 South EIS project area.

11400 South EIS
Bangerter Highway 4-Lane to 6-Lane Conversion - Model Comparison

No Build - 2030									
Location	Bangerter Highway - 4 Lane			Bangerter Highway - 6 Lane			% Change in ADT	% Change in AM	% Change in PM
	Av. Daily Traffic	AM	PM	Av. Daily Traffic	AM	PM			
I-15NB North of 10600	134686	33060	26966	135607	33573	27172	0.68	1.55	0.76
I-15SB North of 10600	136613	17072	37660	136881	17104	37572	0.20	0.19	-0.23
I-15NB North of 11400	121573	31383	24951	121817	31434	24725	0.20	0.16	-0.91
I-15SB North of 11400	121059	14894	34919	121630	14873	35347	0.47	-0.14	1.23
I-15NB North of 12300	121573	31383	24951	121817	31434	24725	0.20	0.16	-0.91
I-15SB North of 12300	121059	14894	34919	121630	14873	35347	0.47	-0.14	1.23
I-15NB South of 12300	113840	29401	23191	113684	29376	22983	-0.14	-0.09	-0.90
I-15SB South of 12300	116007	14485	33575	116248	14471	33936	0.21	-0.10	1.08
10600 @ Jordan	55090	8479	12163	55092	8667	12087	0.00	2.22	-0.62
11400 @ Jordan	18171	3556	6556	17648	3154	6465	-2.88	-11.30	-1.39
12300 @ Jordan	51693	8799	12182	51912	9093	12137	0.42	3.34	-0.37
Bangerter North of 10600	57336	10592	13398	58584	10717	13888	2.18	1.18	3.66
10600 @ Bangerter	44407	7846	10740	44701	7954	11019	0.66	1.38	2.60
Bangerter North of 11400	46349	8502	11325	51064	9727	13598	10.17	14.41	20.07
11400 @ Bangerter	13837	2303	4361	13626	2191	4189	-1.52	-4.86	-3.94
Bangerter North of 12300	37678	6596	8667	41815	7693	10327	10.98	16.63	19.15
12300 @ Bangerter	41077	7143	9395	41339	7117	9497	0.64	-0.36	1.09
Bangerter South of 12300	31104	5454	7714	33515	5988	8946	7.75	9.79	15.97

Alternative 4 - 2030									
Location	Bangerter Highway - 4 Lane			Bangerter Highway - 6 Lane			% Change in ADT	% Change in AM	% Change in PM
	Av. Daily Traffic	AM	PM	Av. Daily Traffic	AM	PM			
I-15NB North of 10600	147872	36173	30284	147618	36168	30096	-0.17	-0.01	-0.62
I-15SB North of 10600	148252	18761	39562	148669	18749	40076	0.28	-0.06	1.30
I-15NB North of 11400	138284	35151	28452	137839	35049	28183	-0.32	-0.29	-0.95
I-15SB North of 11400	138229	16967	38133	138074	16970	37979	-0.11	0.02	-0.40
I-15NB North of 12300	127643	33685	26744	127020	33463	26320	-0.49	-0.66	-1.59
I-15SB North of 12300	127351	15617	36841	126965	15505	36887	-0.30	-0.72	0.12
I-15NB South of 12300	120559	32966	25077	120028	32781	24655	-0.44	-0.56	-1.68
I-15SB South of 12300	121126	15074	36271	121155	15128	35752	0.02	0.36	-1.43
10600 @ Jordan	50305	8561	12847	50259	8528	12731	-0.09	-0.39	-0.90
11400 @ Jordan	45090	7820	11954	45695	7708	12605	1.34	-1.43	5.45
12300 @ Jordan	48697	7758	13087	47031	7459	12993	-3.42	-3.85	-0.72
Bangerter North of 10600	59008	10599	13874	60503	10796	14233	2.53	1.86	2.59
10600 @ Bangerter	44310	7854	10786	44330	8101	10428	0.05	3.14	-3.32
Bangerter North of 11400	47818	8281	10743	54003	9590	13716	12.93	15.81	27.67
11400 @ Bangerter	25228	4703	8144	25363	4487	8315	0.54	-4.59	2.10
Bangerter North of 12300	42633	7216	9541	48875	8684	12111	14.64	20.34	26.94
12300 @ Bangerter	37190	6416	8584	36563	6205	8409	-1.69	-3.29	-2.04
Bangerter South of 12300	35318	6871	8308	39824	8019	10652	12.76	16.71	28.21

Source:
Wasatch Front Regional Council (WFRC)

Notes:	
1	Prepared from raw model data (No Post-Processing)
2	Volume Changes over 10% occur on the Bangerter Highway
3	Volume Change of 11.3% on 11400 South for the No Build Alternative is reflective of low volume on 11400 South during the AM Peak Hour